A

COMPENDIOUS, but a COMPLEAT

SYSTEM

OF

DECIMAL ARITHMETIC

Containing more Exact Rules for ordering *Infinites*, than any hitherto extant.

Contrived by

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TO

JOHN SPOTISWOOD,

Baron of *Spotiſwood*,

ADVOCATE.

SIR,

IT hath been the conſtant cuſtom, amongſt both Ancient and Modern Improvers of Art and Learning, in publiſhing to the World the ingenious productions of their Labour and Study, to make choiſe of ſome fit and well qualified PATRON, under whoſe protection they might have a ſecure retreat againſt the Malice and Calumny of the Ignorant or Emulous. Your skill in *Mathematical* Learning, together with that Generous temper and diſpoſition of Mind (which you ſeem to Derive *ex traduce*) for promoting any thing that tends to the further Improvement of ſuch uſefull Arts, hath emboldned me to commit my ſelf, and the following Sheets to your PATROCINY. Your worthy Anceſtors by their skill in the Laws, both Divine and Humane, have acquired a Name, and given a better Luſtre to your Family, than great Titles are capable to do; your Love to Learning, and the Virtuous courſe you have begun, and in which, without Flattery, you make a conſiderable progreſs, does abundantly demonſtrat that you are a *genuine ſtem* of the ſame Root, and that you do Inherit their Virtue, as well as Repreſent their Family and poſſeſs their Inheritance; I don't queſtion but you, for all that, are much of the Poets mind.

Et Genus & Proavos, & quæ non fecimus ipſi
Vim: ea noſtra voco----

So that their is no Hazard, least you overvalue your self on the account of Progenitors; nay I believe verily you your self would prefer a man of real merit and sense, tho' of meaner Extract, to the greater Pretensions of those that are more Nobly descended; according to that of the Moralist.

Malo Pater tibi sit Thersites, *dummodo tu sis*
Æacidæ *similis*, Vulcaniáq; *arma capessas*,
Quam te Thersitæ *similem producat* Achilles.

What then remains to me to do? To write the History of your worthy Ancestors deserves a better head and a more curious Pen, and to omit other circumstances, neither your Modesty nor my Character (which should be far from the least supicion of Flattery) will allow me to be too particular: Its enough I have mentioned their Virtues in the generall, not only as a Honurable Foundation, on which to raise the Glorious Superstructure, of a lasting Name; but also as a most curious and exact PATERN for your Imitation, to that effect: wherefore I Humbly presume to entreat, and exhort you to be carefull in Transcribing the Copy to the Life, not that I suspect you for negligence herein, but that I am glad to find you at work, and musts needs commend your Diligence.

Qui monet ut facias, quod jam facis ille monendo
Laudat, & hortatu comprobat acta suo.

And now the following Sheets being once received under the shelter of your protection I doubt not but all Ingenious and Ingenuous persons, who have perused the Writings of such as have hitherto treated on this subject, will find themselves obliged to recommend this litle Volumn to the perusal and Study of all those who aim at the attainment of any perfection in this most usefull piece of Learning. It was the Motto over the entry to *Pythagoras* his School, *Ignarus Arithmetices prætereat*, as if none were capable to learn his *Philosophy* without a good previous knowledge in this Art. Indeed it not only concerns the Merchant

... and the Chamberlain but all persons, who have any thing to do in the affairs of this life, to be well skilled in this point. So that this noble Art claims a large share in the Studies of all Persons, of whatsoever Rank or degree, but more especially of those Honourable Persons whose bussiness it is, to plead for, or determine & give sentence concerning the civil Interests of men.

To conclude; whatsoever profit or advantage shall redound either to the publick in general or to privat persons in particular by this litle Treatise I must acknowledge that a great share of the thanks is due to you who have so heartily encouraged the Author: And therefore in dutiful acknowledgement he desires you to accept of this his Slender and sincere Testimony of his gratitude and affection, and that you'd account him always as

SIR,

Your much obliged Servant,

George Brown.

George Brown.

FIRST PRELIMINARY,

Explication of Signes.

3 + 4 = 12. Signifies *Three* and *Four* is Twelve; In which 3 and 4 are the *Items*, and 12 the *Sum*.

7 − 3 = 4. Signifies 7 bate 3, or taking 3 from 7, the Remainder is 4; In which, 7 is the *Charge*, 3 the *Discharge*, & 4 the *Ballance*.

9 × 6 = 54. Signifies, 9 times 6 is 54, in which 9 and 6 are the *Co-efficients*, and 54 the Product.

$\frac{12}{4} = 3$. Signifies, that 12 divided by 4 is 3, in which 12 is the dividend, 4 the Divisor, and 3 the Quotient; this is the way of setting in the literal Arithmetick or Algebra; but in Numbers we express this Operation more frequently, thus, 4)12 (3, read how many times 4 in Twelve, Answer 3 times.

SECOND PRELIMINARY,

How to Add, Substract, Multiply, and Divid by the Fingers.

WHen both Figures are less than 6 there is no difficulty in adding the one to the other, but if both Figures be greater than five, you may make the one on the left, the other on the right Hand, accompting the shut hand five; and if you open one Finger 6, two 7, three 8, and four 9.

In *Subſtraction*, when you take a Figure greater than 5 from any Figure leſs than it ſelf, make the greater Figure on the left hand, and add the ſhut Fingers to the Leſſer, ſo have you the remainder, whereby the leſſer Figure added to Ten exceeds the greater, thus takeing 8 from 1, I make 8 on the left, where I have 2 ſhut Fingers, wherefore I add 2 to 1 the leſſer Figure, ſo have I 3 for a Remainder, or the Exceſs whereby 10+1 exceeds 8.

In *Multiplication*, The ſum of the open Fingers, on both hands, yeilds the Tens, and the product of the ſhut Fingers yeilds the Unites of the Product demanded; thus $7 \times 8 = 56$.

In *Diviſion*, make the Diviſor on the left, and open as many Fingers on the right, as with thoſe on the left, make up the Tens of the Dividend, if the Product of the ſhut Fingers do not exceed the Unites of the Dividend, then the Right hand is the Quotient; but if it do exceed, ſhut one of the Fingers of the right; ſo have you the Quotient: Thus 9)87(having made 9 on the left, you have 4 open Fingers, and becauſe you have 8 Tens in the Dividend, you muſt open other 4 on the Right; and becauſe the Product of the ſhut Fingers, is but one, which is leſſer than 7, (the Unites of the Dividend,) you are ſure to have the Right hand Figure, that is 9×6 in 87: But 9)61(having made 9 on the left, and opning 2 on the right to make out the 60 of the Dividend) you'l find the Product of the ſhut Fingers to be 2, which exceeds the Unites of the Dividend; for which cauſe you muſt ſhut on of the Right, and ſo ſatisfy your ſelf to take 6×9 in 61.

CHAPTER I.

SECT. I.

Concerning the Value and Notation of Numbers.

1. THE Elements of Numbers are, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.

2. Their Value is known by their Order Thus.

100	10	1 One
200	20	2 Two
300	30	3 Three
400	40	4 Four
500	50	5 Five
600	60	6 Six
700	70	7 Seven
800	80	8 Eight
900	90	9 Nine
Hund.	*Tens*	*Unites*

3. By these three Columnes, you may easily perceive, that when any of the Elements stands alone, or next the right Hand, they signify only One, Two, Three, *&c.*

4. But when they occupy the second place from the Right hand, they signify so many Tens.

5. And in the Third place, they signify so many Hundreds.

6. All Numbers consisting of One, Two, or Three Figures, are either to be found in one of these Columnes, or are to be composed out of diverse of them.

7. In their Composition, you must reject the Cyphers of one Columne, when the significant Figures of another ought to take the place. Thus in joyning 5 to 30 you have 35: and 7 to 600 is 607. As also 9, and 50 and 700 being all joyned together make just 759.

If

8. If any Number consist of more places than three, it must be divided into Periods (that is in Threes) beginning at the Right hand, and setting under the second Period (*t*) for Thousands, and under the Third (*m*) Millions, and so forward, making (*m*) after (*t*), and (*t*), after (*m*) not ommitting the last period though imperfect Thus.

g	f	e	d	c	b	a
17	954	683	796	547	901	578
m	*t*	*m*	*t*	*m*	*t*	

9. In reading or pronouncing the value of this Number begin at the left hand, & say [*g*] 17 *Millions of Ms* of *ms* (*f*) 954 *Thousand* (*b*) 683 Millions of *Ms* (*d*) 796 Thousand (*c*) 547 Millions (*b*) 901 Thousand (*a*) 578 Crowns, or Pounds, or Barley Cornes.

10. Here you may observe that at the period (*g*) you pronunce Millions thrice. at (*e*) twice, and at (*c*) but once.

11. With a very little practice, you may easily read any number without pointing or setting down the Letters, meerly by slipping your Finger over the first three next the Right Hand, saying (Thousands) and then over other three, saying (Millions) and so foreward to the last keeping well in minde how oft you have Millions to repeat in returning.

11. In setting down any number, you must observe, that every Period must consist of three places, and the periods ommited in Pronunciation, must all be filled up with Cyphers.

EXAMPLE.

12. were you desired to set down in Figures 3 Hundred & one Thousand Millions of *Ms* of *Ms* of *Ms*, 14 Thousand Millions of

Ms

Ms 1 Million 5 *l*, you must first set down 301, and then because Millions of *Ms* of *Ms* of *Ms* are only named, you set down [000] after which, because Thousands of Millions of *Ms* of *Ms* are both ommitted, you must set down 000 000, then set down 014 for your 14 Thousand and 001 for your 1 Million of *Ms* after these set down 000, for thousands of Millions and 001, for 1 Million and then, 000, for single Thousands, and then last of all 005, for 5 *l*. and the Number will stand thus. 30100000000001400100000100005.

SECTION I.

Concerning the Notation, and value of Fractions, especially of Decimals.

13. IN Numbering, we do not always reckon upon Integer Unites, but many times we are obliged to accompt for the parts of one Unite, and these are commonly represented by two Numbers, the one above and the other below a little line, Thus

$$\frac{1}{2}\ \frac{3}{4}\ \frac{5}{6}\ \frac{125}{360}$$

Numerator / *Denominator*

14. Of those, the Number above the Line, called the Numerator, must be first pronounced, and then that below the line, called the Denominator; adding the word (parts) Thus $\frac{1}{2}$ is, 1 of 2 parts or a half, and $\frac{3}{4}$ is 3 of 4 parts, where you may perceive, that the Denominator intimats in how many parts one Unite, is supposed to be divided, and the Numerator shews how many of those are, or ought to be taken.

15. Some

15. Some times these Fractions are written without Denominators, as in small Denominations: Thus Shillings which are Twenthieth parts of a L. and Pence, which are 12*th*, parts of a *ſh*: As alſo Ownces, Drops, Graines; *Item*. Bolls, Firllots, Pecks, Lippies, *&c.* are all written without Denominators, becauſe it is ſuppoſed, that their Denominators are commonly known.

16 But becauſe theſe common *Fractions*, (admitting of as many ſeveral Denominators, as there are Numbers in the World) which do occaſion a great deal of trouble in their *Addition*, *Subſtraction*, *Multiplication*, and *Diviſion*. Therefore the curious *Arithmeticians* of the late Age have Invented *Decimal Fractions*, which occaſion no ſuch Variety, but may be *Added*, *Subſtracted*, *Multiplyed*, or *Divided*, either alone, or together with *Integers*, as *Integers* themſelves.

17 Theſe *Decimals* are written to the Right Hand of the *Integers*, with a Point [.] before them to diſtinguiſh them from *Integers*: Thus,

.*abcd*

.IIII

Now the Unite *a* ſignifies the *Tenth Part* of an *Integer Unite*, and the Unite *b* ſignifies the *One Hundereth Part* of an *Integer Unite*, or the *Tenth Part* of the Unite *a*, and ſo *c* is the $\frac{1}{10}$ of *b* $\frac{1}{100}$ of *a*, and $\frac{1}{1000}$ of an *Integer Unite*. And ſo, if you pleaſe, you may proceed *in Infinitum*; Suppoſeing always the laſt Unite to be Divided into *Ten Parts*, and any Number of thoſe Parts, below *Ten*, to be ſufficientiy expreſſed by ſome ſingle Figure, ſet towards the Right hand of the Unite divided.

18. In pronuncing the value of ſuch Numbers you may read either, *a*, one *prime* *b*, one Second, *c*, one Third, and *d*, one

d. one fourth, or like whole Numbers, you may say one Thousand, one Hundred, and Eleven fourths, adding only the Denomination of the last figure, which is always easily known by its distance from the Decimal line.

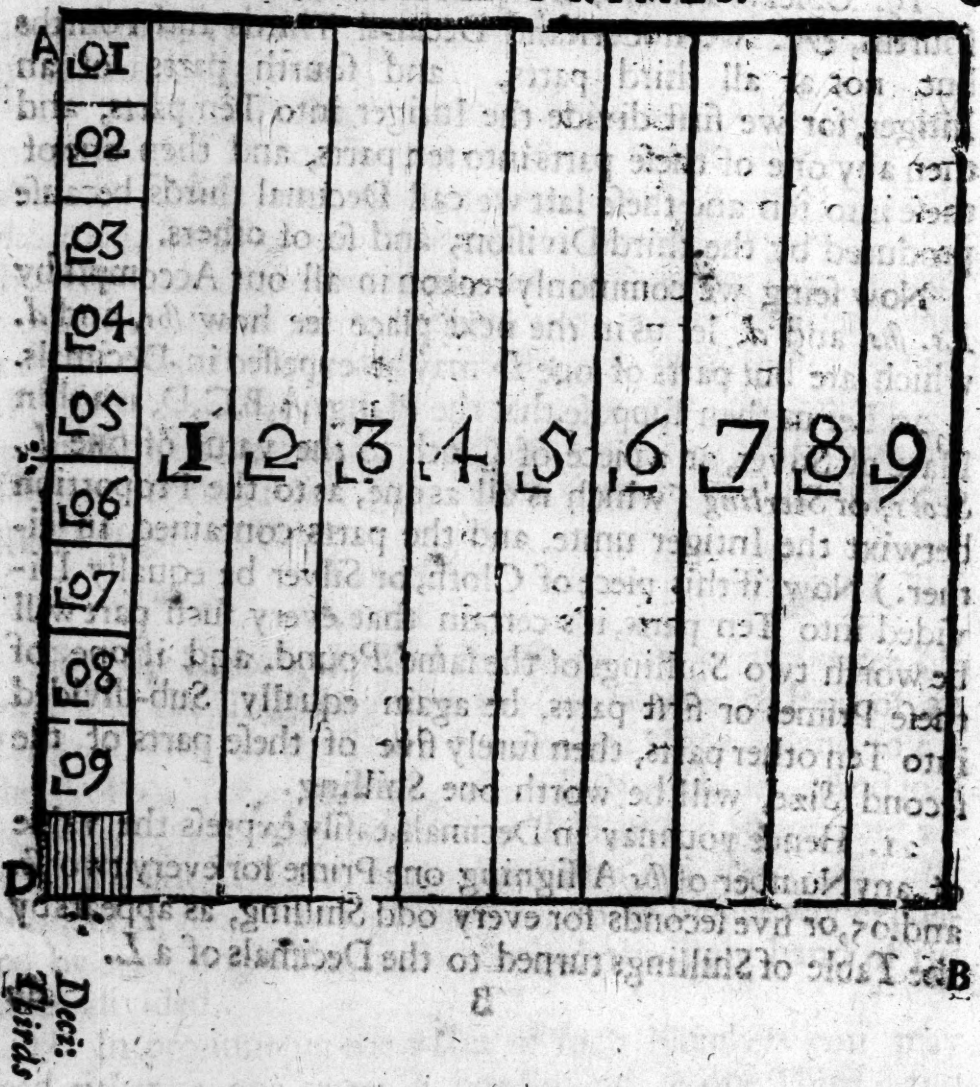
19. Observe always, that when we speak of thirds and fourths, *&c.* we understand Decimal Thirds and Fourths but not at all third parts, and fourth parts of an Intiger, for we first divide the Intiger into Ten parts, and then any one of these parts into ten parts, and then one of these into ten and these last we call Decimal thirds, because produced by the third Division; and so of others.

Now seing we commonly reckon in all our Accompts by *Ls. shs.* and *d.* let us in the next place see how *shs.* and *d.* which are but parts of one *L.* may be expessed in Decimals.

20. Let us then suppose, that the Plang A,B,C,D, is a thin Plate of Silver, or a piece of Cloth to the value of one *L. Scots*, or *Sterling* (which is all as one, as to the Proportion betwixt the Intiger unite, and the parts contained in either.) Now if this piece of Cloth, or Silver be equally Divided into Ten parts, it's certain that every such part will be worth two Shillings of the same Pound, and if one of these Primes or first parts, be again equally Sub-divided into Ten other parts, then surely five of these parts of the second Size, will be worth one Shilling.

21. Hence you may in Decimals, easily expres the value of any Number of *shs.* Assigning one Prime for every two *shs.* and .05, or five seconds for every odd Shilling, as appears by the Table of Shillings turned to the Decimals of a *L.*

An Intiger Unite Decimally divided.



22. Having once made a Table for Shillings, you will easily make one for Pence, and Farthings, after this manner.

First,

N.	*sh.*	*d.*
1	.0	.00416
2	.1	.00833
3	.15	.0125
4	.2	.01666
5	.25	.02083
6	.3	.025
7	.35	.02916
8	.4	.03333
9	.45	.0375
10	.5	.04166
11	.55	.04583
12	.6	
13	.65	
14	.7	
15	.75	
16	.8	
17	.85	
18	.9	
19	.95	

Shillings Decims. Of a L.

d. turned to Decimals of a L.

First, Divide the Decimal of one Shilling by 2, so have you the Decimal of 6 *d.* and the Decimal of 6 *d.* Divided by 2, yeilds the Decimal for 3 *d.* and this divided by 3, yeilds the Decimal of 1 *d.* Thus,

2) .05 - - - 1 *sh.*
2) .025 - - - 6 *d.*
3) .0125 - - 3 *d.*
.00416 - - - 1 *d.*

Here you see the Decimal, for one penny is infinite, and yet you may limit it at any one of the reiterated Figures after Decimal thirds, or you may extend it as much further as you please.

23. The Rules to be observed in ordering Infinites, are these, First, yon must not Limitt them under Decimals thirds.

Secondly, Nor then, unless they contain one of the reiterated Figures.

Thirdly in Addition and Substraction, they must exceed the longest *F*inites, at least by one step towards the Right hand.

*F*ourthly, Infinites must, in Addition, and Substraction be equal in Number of Places.

 Fifthly,

Fifthly, Having once limited them, you must reckon the figure next the Right hand of an Infinite, as Ninth parts, but not as Tenths of the next preceeding Unites; and for that cause, you must in Addition and Multiplication, carry one for every Nine of the Sum, or Product; and in Substraction and Division, reckon upon *Nine*, for every one of the borrowed, or Imaginary prefix.

Lastly, The Sum and Product, or remainder of Infinites, is always Infinite, unless it end in a Cypher.

24. These premised, and well considered, you may make the Table for Pence after the following manner.

First, set down a Columne for Pence, from one to 11. and against 1. set down the Decimal for one Penny formerly found, to wit, .00416, which being limitted at Decimal *5ths* you must reckon the *5ths* as if they were *9th* parts of the Decimal *4ths*, and this multiplyed by every Number, from one to 10, will yeild the Decimals for 2, 3, 4, 5, 6, 7, 8, 9, 10, *d.* and the Decimal for 10 *d.* added to that for one, yeilds the Decimal for 11 *d.* as in the *Margin* you may perceive by the Table, that tho 2x 6= 12, I set 3 the excess above 9, and carry one to the next Product, also at 8x6=48, I set 3, and carry [5] for so many 9's.

25. In one word when the Sum or product of the *Limiting* or Right hand Figure, or Figures of Infinites amounts to a number of two *Figures*, you must always set down the Sum of the two *Figures*, when it is less then Nine, and the Overplus, when it amounts to Nine, and carry only the prefix of the two *Figures*, when their Sum is less than Nine, but you must carry one more than the prefix whensoever the Sum of the two amounts to 9, or contains 9; Thus if the Sum or *Product* were 42, whereas in Intigers, and finite

Decimals,

Decimals, I behoved to ſet 2 and carry 4, here I muſt ſet 6, to wit 4 + 2 and carry 4, but if the Sum had been 48, becauſe 4+8 = 12, I muſt ſet 3 the overplus, or exceſs of 12-9, and carry 5, which is 1 more than 4, or 1+4.

26. There will be frequent occaſion to exhibite one Decimal for ſome Number of Shillings and pence together, which you may eaſily do, by joyning the Seconds of both into one figure, Thus, were it demanded to ſet down in Decimals 3 L. 17 ſh. 6 d. you muſt put the .05 of the Shillings, and the .02 of the Pence into one figure; ſo will you have 3.875 L. for the Number deſired, you muſt endeavour to be exact Maſter of the Decimals for ſhs. and Pence, and all the little Labour you are at in doing this, will be abundantly recompenſed, by ſaving you almoſt in every Leſſon, 4 parts of 5 of the Labour, you might otherways be at by the Vulgar Arithmetick.

27 If you reckon by Engliſh *Money*, you will ſome times have uſe for Farthings, which you may readily expreſs in Decimals Thus,

The Decimal for one Penny is - - - - .00416.

The fourth of this is the Decimal for one Farthings, to wit, - - - - - - - .0010416

And the halfe of that for one penny is the Decimal for ½ d. or two farthings, to wit, .0020833

And the Sum of thoſe for one and 2 farthings, is the Decimal for 3 farthings, to wit, - .003125

28. When you have occaſion for L. ſh. d. and Farths all in one Sum ſet firſt down the *L.* ſh. d. in one Sum, and to them Subjoyn the Decimal for the farthings propoſed, theſe added, yeild the Number deſired.

For

For *EXAMPLE.*

29. Suppose a Prince, on account of some notable Victory, were resolved to distribute amongst 10, or 100, or 1000, or 10000, or 100000 Soldiers a largess of 7 L. 15 sh. 4 d. $\frac{1}{4}$ to each how much will serve to pay them all.

First 7 l. 15 sh. 4 d. is	7.7666666
And 1 Farth. is	.0010416
The Sum of both is	7.7677083

Now, this Sum which exhibites in Decimals, what every single man ought to have, does likeways at the same time intimate how much will serve a whole party of 10, 100, 1000, 10000, or 100000,

		lib	*sh*	*d*
For if one Man must have	7.7677083 :	7	.15	.4 $\frac{1}{4}$
Then ten must have among them	77.677083 :	77	.13	6 $\frac{1}{2}$
And Hunder will require	776.77083 :	776	.15	.5
And thousand will require	7767.7083 :	7767	.14	.2
And Ten Thousand must have	77677.083 :	77677	.1	.8
Lastly, 100000 will require	776770.833 :	776770	.16	.8

All which is done meerly by removing the Decimal point so many steps nearer the Right hand, as you have Cyphers in your Co-efficient.

30. Let us also suppose a Captain were to distribute 375 l. among Ten, or a Hunder, or a Thousand, or Ten Thousand Men, what shall every Man have to share.

First, every one of 10 shall have	37.5	37	10	00
And every one of 100 shall have	3.75	3	15	00
And every one of 1000 shall have	.375	..	07	06
Lastly, every one of 10000 shall have	.0375	..	..	.9

All which is done meerly by removeing the Decimal point (which is always supposed to follow the Intiger Unites)

so many steps nearer the left hand as there are Cyphers in the Divisor.

31. If you please to *Multiply* the products of the first Lesson, or divide the Quotients of the 2d by 2. 3. 4. *&c.*

You shall easily answer the like Questions, for 20, 200, 30, 300, *&c.*

32. To conclude this Section, it will be sometimes requisite to express in Decimals a common Fraction, which you may easily do when the Deominator is but one figure, by adding as many Cyphers to the Numerator, as shall be needful, and dividing that Number by the Denominator, so shall you have the Decimal required. Thus for $\frac{7}{8}$ set down,

8) 7000 and Divide till nothing, either remain, or the Quotient reiterat.

.875

But for $\frac{1}{3}$ set 3)1000

.333

And you see the Decimal is Infinite.

33. By this you will find, that all the reiterated figures of any infinite, from whatsoever Numbers they proceed, are but so many *9th* parts of the preceeding Unite for $\frac{1}{9}$ is .111. and $\frac{2}{9}$ is .222. and $\frac{3}{4}$ is .333 *&c.* and $\frac{4}{900}$ is .0444 and $\frac{5}{900}$ is .00555

This CHAPTER *well understood, I reckon you have done with more than halfe your Labour,*

Dimidium facti qui bene cœpit habet.

SECT

SECTION II.

I shall here Subjoyn some Examples of Addition without, and with Infinites.

I. Example of			The same in Decimals.
Lib.	sh.	d.	
35	15	9	35.8958
296	15	6	296.775
81	17	3	81.8725
3476	10	0	3476.5
9437	11	9	9437.5875
13255	10	3	13255.5625

II. Example of			The same in Decimals.
Lib.	sh.	d.	
345	19	10	345.99166
17	18	8	17.93333
246	13	4	246.66666
175	01	6	175.525
983	10	9	983.4375
7	18	10	7.94166
1777	12	11	1777.64583

35. In the Decimal Tables the sum of the limitting Columne amounting to 21, and 2†1 being 3, I set 3 at the foot and carry 2, as you have been already taught at Num: 23. *Sect.* 2*d.* and thereafter proceed as in Intigers.

Exam-

In the Leſſons of Species you carry one for every Twelve of the Pence, to the Shillings; and having told up the Unites of the Shillings, you ſet down the Unites of the Sum, and carry the *Tens* to the ſecond Column, and if the Sum of the *Tens* of the ſhillings be even, you ſet down 0. and carry the half, but if it be odd, you ſet down the odd Unite, and carry the half of the Remainder to the Unites of the Pounds, in which you ſet the Unites of the ſum of every Column at the Foot of the Column, and carry the *Tens* to the next preceeding, till under that next the Left Hand you ſet down the whole Sum.

36 *Example of* Ls. ſhs. Pence, *and* Farthings, *done both ways.*

Ls	*ſhs.*	*d.*	*far.*	
1769	13	6	2	1769.675
				.0020833
358	17	8	3	358.88333
				.003125
9764	19	10	1	9764.9916666
				.0010416
493	11	11	2	493.5958333
				.0020833
12387	3	1	0	12387.1541666

37. In the Decimal Leſſon I have ſet thoſe for Farthings by themſelves, without adding them ſeverally to the reſpective Decimals for *ſhs* & *Pence* to which they are annexed.

SECTION III.

Containing Examples of SUBSTRACTION.

SUBSTRACTION finds the difference betwixt two unequal Numbers.

The greater of these two Numbers we call the *Charge*, and the lesser the *Discharge*, and the difference betwixt the two, we call the Ballance.

Observe, That how many soever of any one species are requisite to make one of the next greater: That Number we call *The Denominator of the lesser Species*,

Thus in Intigers 10 is always the *Denominator*; Because 10 in the Columne of Unites, makes but one in the Columne of Tens; and 10 in the Columne of Tens, makes but one in the Columne of Hundreds, *&c.* Nay the *Denominator* of Tens is 100, *&c.*

Also, 4 is the *Denominator* of Farthings, Eippies, Firlots: and Pecks in relation to Firlots; but 16 is the *Denominator* of Bolls, and of Pecks in relation to Bolls; and 12 the *Denominator* of pence, and 20 of shillings, *&c.* This is well to be minded.

When the Figures of the Discharge are less, than the respective Figures of the Charge, you must in that case take the figure of the Discharge from the *Denominator* of the *Species*, and add the overplus to the respective Figure of the Charge; so have you the Remainder: and minde well that how often soever this happens, you must repute the next preceeding Figure of the Discharge, an Unite more, than really it is.

Thus in the following example I take 8*d* from 12. and the

overplus 4 I add to 2 *d.* of the Charge ſo have I 6 for a remainder and thence proceeding to the ſhillings I repute the 15 of the Diſcharge 16, which being greater than 15 in the Charge I take 16 from 20 and the 4 of overplus I add to 15 ſo have I 19 for a remainder and thence I proceed to the pounds carring an Unite and borrowing zero as occaſion requires.

1785	15	2	*Charge*
0392	15	8	*Diſcharge*
1392	19	6	*Ballance*

Example of finite Decimals

375[12.75]
1968[7.9875]
17724.7625

Example with an Infinite in the Charge

79214.88333
47362.875
31852.49583

38 The Two Dashed Figures are added that the Infinite may exceed the Finite; as *per N.* 23. *R.* 3. *S.* 2.

When the Sum of the *Ballance* and *Diſcharge* does equal the Charge, it proves the Leſſon Right.

Example with an Infinite in the Diſcharge

7436.85
6749.883
.686,66

Example with an Infinite in both

875.88333
697.97916
177.90416

83 Here you begin, ſaying, 3 from 9. The reſt as before Say not 6 from 13, but from 9[13]=12, remains 6.

SECTION IV.

Concerning MULTIPLICATION.

MUltiplication ſuppoſes Two Numbers, called *Coefficients*, to find a Third, called the *Product*, which Product contains any one of the Coefficients, as oft as the other contains an *Unite*.

Any one of the Coefficients, eſpecially the Greater, may be called the *Multiplicand*, and the other, the *Multiplier*; Thus 3 times 4 is 12, of which 3 and 4 are the *Coefficients*, and 12 the *Product*, which Product contains 3, as oft as 4 contains 1.

When one of the Coefficients is 10, 100, 1000, your buſineſs is done merely by adding the Cyphers to the Right Hand of the other Coefficient. Thus, 10×64 is 640, and 100×64 is 6400, *&c.*

40 Now if you are to Multiply by 20, 30, 200, 300, or any ſuch Number conſiſting of one *Signifying Figure* prefixed to One, Two, Three, or more Cyphers, you muſt ſet down the Numbers after this manner;

7968	8795	98750
20	300	5000
159360	2638500	493750000

In which Examples you muſt firſt Multiply by the *Signifying Figure*, and to the Product you muſt Add as many Cyphers as there are in the Multiplyer

41 In caſe an Infinite Decimal be annexed to the Multiplicand, you muſt inſtead of the Cyphers annexed to the Multiplyer, as often reiterate the laſt Figure of the Product.

And

And remember always that the Decimals of the Product ought to be in number of Places equal to the Decimals of both Coefficients; For Example,

79.666	874.333	84.777
500	9000	8000
39833.333	7869000.000	678222.222

42 In the first Example, because 5×6 is 30, which being 3. over 3. nines I set, 3. and because of the two Cyphers annexed to the Multiplier, I Reiterate the last figure of the product twice, the same is done in the last, as to the Second Example, I needed not to have reiterated the last Cypher, had it not been to ascertain, that all the Number before the Decimal Point is Intigers.

43 When the Multiplyer consists of several signifying Figures with or without Cyphers annexed or intermixed you must in setiug down evry particular product, leave as many Blank places to the Right Hand of it, as there are places to the Right Hand of the coefficient Figure of it's production.

And in case an Infinite be annexed to the Multiplicand these Blanks before Addition must be filled up by reiterating the last Figure of every particular product and then the Sum of all these products added together is the Product desired.

FOR EXAMPLE,

7479.5	47.635	97.333
375.6	4007500	68.55
448770	23817500	486666
373975	333445	4866666
523565	190540	77866666
224385	190897262,500	584000
2809300.20		6672.20000

In

In the first Example you see the Second particular product hath one Blank behind it, the third two and the 4th. three. In the second Example the Second product hath three and the third Six Blanks according to the Number of places to the right hand of the coefficient Figures 7. & 4.

In the third Example the Blank of the 2d. and the two Blanks of the third product are supplied by reiterating the last Figure of each, as you may see by the Dashed Figures.

44 If an Infinite be only annexed to one of the Coefficients it will be easiest to make that coefficient the Multiplicand; but if you make it the Multiplyer, you must chuse all the Reiterated Figures of the Decimal to the Right hand of the Multiplyer behind the last Figure of the Multiplicand: like Cyphers, and instead of Multiplying by them,

45 You must (if they are 3d. Figures) take the third of the Multiplicand.

46 But if they are 6th. Figures, you must take the third of the Multiplicand twice.

47 And if the reitetrated Figures are any other than thirds or Sixth Figures, you must Multiply the ninth part of the Multiplicand by one of these Reiterated Figures.

37 666		985	
9.85		37 666	
188333		3283	
3013333		32830	
339000		6895	
371.01666		2955	
		371.016	

You

48 You see that both ways the product is the same only here in cutting off the Decimals we do not reckon the reiterated Figures in the last Example?

Examples of Decimal Infinites in one or both Coefficients.

$a = 7985$ — $a = 257.666$

$\frac{a}{9} = 887.222$ — $\frac{a}{3} = 85.888$

$5 \times a = 44361.11$ — 2061.333

$7 \times a = 55895$ — 2319.000

$40 \times a = 31940$ — 770.000

10263.7222

49 You see in the last Example, that there are Four Decimal Places in the Product, because there are Three in the Multiplicand, and but One in the Multiplyer, without regard to the Two reiterated Figures any further than the parts taken do proceed with them. I shall now subjoyn some useful Questions concerning the Measuring of Glass, and Timber-Board-Work, or Cubical Solids, *&c.*

It must be Remembred that Eight Inches is the Length of the Glass-Foot-Measure, and Twelve Inches the Length of the Foot-Measure of Timber, or other things.

There is a piece of Glass-Work 5 *Foot*, 6 *Inches*, *or* $5\frac{3}{4}$ *Foot long*, *and* 3 *Foot* 7 *Inches*, *or* $3\frac{7}{12}$ *Foot broad*: *How many Square Foots are there in the whole?*

3 Foot 7 Inches = 3.875 broad,
5 Foot 6 Inches = 5.75 long,

19375
27125
19375
22.28125
.225
111406 25
4456250
4456250
5.01328125

50. Answer, 22 Foot, and little more than a Quarter.

Suppose the Square Foot of Glass should cost 4 *sh.* 6 *d. Sterl.* how much will the foresaid Plang of Glass amount to?

Answer, 5 *l.* 0 *sh.* 3 *d.* and little less than One *Farthing.*

51. There is a piece of Timber-Board-Work, 15 Foot, 10 Inches long, and 7 Foot 4 Inches broad, How many Square Foots are there in the whole?

Foots,	*Inches,*
15	10 = 15.8333
7	4 = 7.333

52777
1108333
116.1111
.375
5805555
81277777
348333333
43.5416666

Answer 11.6, Foots compleat.

52. At 7 *sh.* 6 *d. per* Foot, what will the whole amount to?

Answer, 43 *l.* 10 *sh.* 10 *d.* to an Ace.

53 There

53. There is a piece of Solid Matter, suppose a parcel of *Cedar*-Wood, or *Pedestal* of Stone, 8 Foot, 3 Inches long, 5 Foot, 6 Inches brood, & 4 Foot, 9 Inches deep, or thick. *Queritur*, How manie Cubical Foot does the same contain?

8 Foot, 3 Inches	=	8.25 long.
5 Foot, 6 Inches	=	5.5 broad
		4125
		4125
Superficial Content of one Base		45.375
Thickness		4.75
		226875
		317625
		181500
Answer, 215¼ Cubical Foot, and some little more.		215.53125
		375
		107765625
54. At 7*sh.* 6 *d. sterl. per* Foot, what does the whole amount to?		150871875
		64659375
Answer, 80*lib.* 16*sh.* 5 *d.* or so,		80.82421875

Observe, That in the preceeding Examples, the Angles are supposed to be Right, *or Square Angles, whether in Solids or Superfices.*

55. After the same manner You may measure Tillings, and Slate-Work, Brick-Walls, and Park-Dikes, or a Square or long Square of Ground, merely by *Multiplying* the Length by the Breadth, and the Product Yeilds the Answer of the Squares desired in whatsoever Measure.

In effect, by this Rule alone You may answer most Questions of the *Rule of Three*, especially when the Divisor is an Unite, that is when the price of one *lib*, ell, or Boll, or the Value of one Peice of Money is knowen you will easily find the price or value of any Number assigned of the same sort, at the same Rate, of which take these few Examples.

56 At 3*lib*. 15*sh*. 6*d*. the ell, what cost 756, ells?

Having put your shillings and pence into Decimals as also the Fraction. Multiply the one Number by the other and the Product answers the Question, thus

	Lib.
	3.775
	756.5
	18875
	22650
	18875
	26425
	2855.7875 Answer 2855*lib*. 15*sh*. 9*d*.

It is Indifferent which of the two Numbers you Make the Multiplicand only it is most convenient when you have an Infinite to make the Number to which it is annexed the Multiplicand.

57. At 3*lib*. 14*sh*. *Scots per* piece, how many Pound Scots or Sterling are there in 456½ Ducatoones.

.3083 *Sterl. L.* 456.5 *Ducat.*
456.5 *Duc.* 3.7 *L. Scots*
15416 31955
18500 13695
1541666 1689.05 *Scots*
12333333
140.75416 *Sterline*

So that you may see, that the same Number of Ducatoons which makes 1689*lib.* 1*sh.* Scots makes but 140*lib.* 15*sh.* 1*d* Ster.

58. You may try your skill by as many more Examples of this kind, as you please: Observing alwayes to Multiply the Number assigned by the price or value of one of the same sort.

a = 756.5 *Marks Scots* 504.333 *L. Scots value*
.666 *value of* 1 *Mark* 1.5 *of* 1 *L. in Marks*
2521666 2521666
2521686 5043333
504.3333 Answr 756.5000 *Marks* 756½
Answer, 504*L.* 6*sh.* 8*d.* Scots

Thus you see 756½ Merks come to 504*lib.* 6*sh.* 8*d* Scots which returned comes again 756½ Merks.

575.75 *L. Ster.* 10363.5 *M*
18 *M. Scots the value* .055 *Ster.*
46060 *of* 1 *L.* 1 *of the M* 115.15 *the value*
57575 5 *of* 1 *M.*
10363.50 *Merks* 575.75

Observe, in the last Example that the Ninth part of the Multiplicand hath two Decimals, to wit, one for that of the Multiplicand, and one for the cypher Decimal of the Multiplyer.

59. I shall conclude this Section with that Famous Example of Multiplying 3*L*. 19*sh*. 6*d*. by 3*L*. 19*sh*. 6*d*.

3.975
2.975
19875
27825
35775
11925
15.800625

Whereas 4*L*. x 4*L*. = 16 *L*.
3*L*.19*sh*.6*d*. x 3*L*.19*sh*.6*d*. = 16*L*.

which is agreeable to what we have here found to wit 15*lib*. 16*sh*. and a little more than ½ a Farthing.

SECTION V.

Concerning DIVISION.

60. DIVISION serves to find a Number shewing how oft the Greater contains the Lesser.

The Greater of the given Numbers we call the *Dividend*, the Lesser the *Divisor*, and the Number demanded or found, the *Quotient*.

61. When as many Figures taken from the Left of the Dividend, as there are Figures in the Divisor, are Equivalent to the Divisor, or better than it, then we set a Point

On-

over the last of these, to Determine the first particular Dividend, which, for Brevity, I shall call the *First Dividuall*.

62. But if as many taken from the left of the Dividend, be less than the Divisor, the Point must stand over the nixt subsequent Figure of the Dividend for determining the first Dividuall.

63. Having determined your Dividuall, you must refer the first of the Divisor (when they are equall in number of places) to the First of your Dividuall; but if they are unequall to the First two of the Dividuall, and so forward, the second, third, and fourth figures of the Divisor to the Subsequent Figures of your Dividuall as they ly in order; So that in Subduction, where you begin at the last Divisor you must refer or Substract the Product of it from the last of the Dividuall.

64. The Remainder of the first Dividuall with the nixt following Figure of the Dividend Yeilds you a second Dividuall.

65. So soon as you have determined your first Dividuall you presently understand, how many Figures you are to have in the Quotient, to wit, one for the Point, or first Dividuall; and one for every Subsequent Figure of the Dividend.

66. Wherefore, if the 2d, 3d, or any other Dividuall should happen to be less than the Divisor, you must put a Cypher to the Quotient for that Dividuall; And so (as if it were but a new Remainder) bring down another Figure from the Dividend; to wit, the nixt following for a new Dividuall.

I shall first shew you how to Divide by one Figure, and then by two, and after that by as many as you please.

67.

67. First set your Divisor to the left of your Dividend and having marked the First Dividuall, with a point over the last Figure of it; then take the half, third, or fourth of your Dividuall according as your Divisor is 2, 3, or 4, carrying the overplus of the Dividuall (when it does not admitt of being Divided equally in two, three, or four parts) as a pressit, or tenst to the next Subsequent Figure of the Dividend, for a second Dividuall, supplying with Decimall Cyphers to the Right of the Dividend, till you either totally exhaust the Remainder, or come to an Infinit, or at least to such a competent number of Decimalls (that is Five in Scots and Seven in Sterling) as is sufficient to express the value of the Fraction in shillings, pence and Farthings as near as can be.

68. For Example were it demanded to Divide 74975 *libs.* amongst 2, 3, or 4 then what would each mans share be?

Divisor	*Dividend*	*Dor, Dnd,*	*Dor, Dnd,*
2	74975	3	4
Q 37487·5		74975	74975
74975·0	Q 24991·666	Q 18743·75	
	74975·000	74975·00	

You see I have marked the Quotients with a Q. and proven the examples by Multiplication.

69. When your Divisor is 5. Double your Dividend letting every Figure one step nearer the Right than it ought to be, and making the Figure next the Right hand a *Decimall*, and so you have the *fifth* part demanded: because the 10*th* part of the Double is always the *fifth* part of the Number proposed thus.

5)

5) 9786853 *Dividend*
1957370.6 *Quotient*,
9786853

You see I set 6, the double of 3, one step nearer the Right Hand and the rest in order but in Multiplication by five I set 9, the half of 19 one step nearer the left, to wit, under the foremost Figure of 19 and the rest in order.

Hence you may see that doubling is the easiest way of Dividing by 5, as halfing is, of multiplying thereby.

7o. Also in Multiplying and Dividing by 9, you may do thus: In Multiplying add a Cypher to the Multiplicand, and from that Number Substract the Multiplicand so have you the product by Subtraction. But in Division by 9, if the Sum of the Figures of your Dividuall be less than 9, the prefix is your Quotient and the Sum your remainder; but if the Sum ammount to 9 you must add one to the prefix of your Dividuall, so have you the Quotient and the overplus of the Sum above 9 is the Remainder. Thus,

9) 70568451 *Dividend*,
7840939.0 *Quotient*,
7840939
70568451

1 the first Dividual because 7+0=7 which is less than 9, I have 7 the prefix for my First Quotient and 7 the Sum for my Remainder, which with the following Figure (to witt 5 of my Dividend) makes 75 and here the Sum, to witt 12, amounting to more than 9 I add one to 7 the prefix, so have I, 8 for my Quotient and 3 the overplus of 12 above

above 9, for a prefix to the next Subsequent Figure of my Dividend.

In the *Multiplication*, the Unites of the Quotient might be Substracted from the Decimall Cypher, and the tens from the Units &c. without seting down as I have done, *illustrandi causa*.

71. When your Divisor is 6, 7, or 8, you may use the help of your Fingers conform to the Direction in the end of the 2*d*. Preliminary.

71. When you are to Devide by two Figures, you may mark the foremost of Your Divisor with *a* the other with *b*, as also the foremost one or two of your Dividuall with *c*, and the other with *d*:

Then enquire how many times the *Figure a* may be had in the *Figure* or *Figures c* and consider whither the Remainder of *c* togither with *d* makes a number that does equall or exceed as many times the *Figure b* which if it do, you have the Quotient but if it be less you must abate one Unite from the Quotient and enter upon a new consideration and so foreward till you have found the Quotient desired.

73. Observe that the Remainder of *c* which is the prefix of *d* groweth at every Units abatement from the Quotient, according to the foremost *Figure* or the *a* of the *Divisor* that is 10, 20, 30, 40, &c. when the foremost *Figure* of the *Divisor* is one, 2, 3, 4, &c.

Also

Also the Quotient must stand to the right of the Dividend, thus,

```
        a b     c d
        1 9 ) 908 ( 48.842
              148
              160
              080
              040
              ---
              092
```

In this example observe that if you take,

9				00
or 8			then *d* of the	10
or 7	times	*a* from *c*	Dividend will	20
or 6		1 9	become	30
or 5				40
or 4				50

Wherefore you must proceed in this manner saying How many times 1 (*a*) can I have in 9 (*c*) answer 9 times; But can I also have

9				0
or 8				10
or 7	times	*b*	in 20	no
or 6		9		30
or 5				40
or 4				50 Yes;

Whereupon you put 4 in your Quotient, and Multiplying 9 (*b*) by 4 you take 36 the product from *d* 40 and the overplus 4 you set under 0 (*d*) after which Multiplying 1 (*a*) by 4 the Quotient, and adding 4 because you reputed (*d*) 40 so you have 8 which taken from 9 (*c*) the Remainder 1 must be set down below 9 (*c*)

Had the foremoſt *Figure* of the diviſor been 2 then 0 (*d*) had ſwelled to 20, 40, 60, &c. at the ſeverall abatements as was hinted at in the Number 73.

74. If you deal by the ſecond and Subſequent dividuall as I have done by the firſt you will eaſily diſpatch the whole Buſſineſs

75 When your Diviſor conſiſts of more *Figures* then two you muſt find the Quotient for the foremoſt two as is already taught but then you muſt further conſider whether the remainder of the foremoſt two of the *Dividual* can make the Subſequent Equivalent to the Product of the ſubſequent Figures of the Diviſor, which if it do, you have found the Quotient: but if it do not, you muſt ſatisfy your ſelf to to take the Quotient an Unite leſs, which in this caſe will allways do the buſineſs.

EXAMPLE *a b c d* *e f g h*

1598) 1 1 0 4 5 6 (69

1 4 5 7 6

0 1 9 4

In this Example after I had diſcovered that I might have 7 x 15 (*a b*) of the Diviſor in 110 (*e f*) of the Dvidual, yet becauſe the Remainder at 0 (*f*) was but 5 which made 4 (*g*) become but 54, and conſidering that 7x9 (*c*) exceeds 54, I behoved to ſatisfy my ſelf with 6 for a Quotient

I have a way of teaching all this by two Labbels of Paper more eaſily then can in words or Writings, be diſgeſted.

SECTION VI.

Concerning the Regulation of Decimals *in Diviſion.*

76 IN Diviſion having placed the point for the firſt Dividual you Inſtantly know how many Figures you are to have in the Quotient namely one for that Figure over

over which the point ſtandeth and one for every ſubſequeut Figure of the Dividend beſides one for every Cypher or reiterated Figure added in the prolongation of the work.

77. When in Integers or finit Decimals any thing remains after the Dividend is exhauſted, you may add on Cypher after another and ſo prolong the work till you have found a ſufficient Number of Decimals to expreſs the parts belonging to the Quotient and the Number of Decimal Cyphers, added in the prolongation of the work ſhewes how many more Decimals places you are to have in the Quotient.

78 But you muſt alwayes carefully obſerve, that the Decimal places of the Dividend alone, are or muſt be equal to thoſe of the Diviſor and Quotient both together.

79. Wherefore if the Diviſor have not, but the Dividend hath Decimals annexed to it, the Decimals of the Quotient muſt be equal to thoſe of the Dividend.

80 If the Diviſor have Decimals annexed to it but the Dividend hath none or fewer you muſt Compenſe thoſe of the Dividend, by adding as many Decimal Cyphers to the Dividend as there are Decimals annexed to the Diviſor and for all thoſe the Quotient will be Intigers, unleſs you add moe Cyphers in the prolongation of the work.

81 If the Decimals annexed to the Diviſor and Dividend be both of them finite the Operation is the ſame as if they were Integers.

82 But if the Decimals annexed to the Dividend be Infinite and the Diviſor an Intiger, or a finite, then in the prolongation of the work, you muſt not add a Cypher, but in ſtead of that, you muſt reiterate the laſt Figure of the firſt Dividend as oft as you ſhall think fitting.

83 When the Diviſor is Infinit, and the Dividend finit you muſt before you proceed to Subduction, add a Cypher to the Dividend conform to what you were taught at the third Rule of the firſt Section for ordering Infinits *v. N.* 23.

84 In this caſe after you have found the Figure in the Quotient you muſt not begin the Subduction at that Figure of the Dividend over which the point ſtandeth; but at the laſt Figure of the Dividend, as if the Infinit annexed to the Diviſor were extended according to the Number of places or Figures poſterior to he Dividual point of the Dividend, ſo that the laſt Figure of the Diviſor is ſubducted from the Figure over which the *Dividual* point doth ſtand.

85 Remember alwayes when the *Diviſor* is Infinit to remove the *Dividual* point over the Remainder after every Subduction one ſtep nearer the right hand.

86 Alſo after the *Dividend* is quite exhauſted that is when Subduction hath been made, after the Dividual point hath ſtood over the laſt Figure you muſt in the prolongation of the work reiterat always the laſt Figure of the laſt Remainder when the Diviſor is Infinite.

87 If both *Diviſor* and *Dividend* be Infinit you add no Cypher to the *Dividend* before Operation.

88 If at any time there ſhould happen to be no Remainder the *Dividend* being wholy exhauſted before you have found ſo many Figures for the *Quotient* as the *Dividual* point Intimates you ought to have: then, and in this caſe you muſt ſupply with Cyphers in the Quotient, the wanting places by poſtponing as many as are requiſit.

89 Laſtly, if the places in the Quotient happen to be fewer than the Rules for *Decimals* require the *Decimals* to be (which you will eaſily perceive before Operation,

the

the *Dividual* point Intimating how many Figures you are to have in your Quotient and the first Rule of this Section (declaring how many *Decimals* ought to be in it) you must in this case Supply that defect by perfixing within the *Decimal* lyne as many Cyphers as are necessary.

Examples of what hath been said shall conclude this Section

Qu. 1*st*. If 38 ¼ ells coast 144 *L*. 7 *sh*. 10 ½ *d*, what will one ell cost.

Divisor,	*Dividend*,	*Quotient*
38.25)	144.39375	(3.775 3 *L*. 15 *sh*. 6 *d*
	29643	
	28687	
	19125	
vide N. 76. and 78.	0000	

Qu. 2*d*. When 1067 *L*. 17 *sh*. *Scots* Exchanges for 378 *French* Crowns what is the rate of one Crown.

378) 1067.85 (2.825

3218

945

1890

1000 *vide N.* 78. *Item N.* 77.

Qu. 3*d*. At 3 *L*. 5 *sh*. *per* Crown how many Crownes may one have in Exchange of 220831 *L*. *Scots*.

3.25) 220831.00 (67948

2583

3081

1560

2600

0000 *vide N.* 78. and *N.* 80.

Qu.

Qu. 4th. At 94L. 7sh. 6d. *per* Acre how many may one Purchase for 6115L. 10sh.

94.375) 6115.500 (64.8
453000
755000
000000 *vide N.* 78. and *N.* 80 and 81.

Qu. 5th. at 5L. 15. *sh.* *per* Boll how many Bolls will be got for 561L. 11sh. 8d.

5.75) 561.583 (97.666
4408
3833
3833 and so in Infinitum because the same remainder and Dividual with the former.
vide N. 78. and 81.

Qu. 6th. suppose 88 men had to Divide amongst them 8469L. 3sh. with provision that 87 of the number should have equal shares but one of the number is only to have a third part of an equal share you must do thus to find the quantity of an equal share.

87.333) 8469.150 (96.975
609150 *vide N.* 84, and 85,
851500
655000 *vide N.* 78. and 86.
436666 *vide N.* 78. and 86.
00000

You see the equal sharers are to have 96 L, 19sh, 6d, *per* piece and the other who is to have but a third Share must have 32 L, 6sh. 6d,

Qu. 7th, 41 men have gained in Company amongst them

257 *L.* 13 *sh.* 4 *d.* of which 39 men are to have equal Shares, and two of the Number are to have one of them a half and the other a third Share,

39.833) 257.666 (6.4686
186666
273333
343333
246666 *vide N.* 87, and 86.

Qu. 8*th*, 35 ½ *sh. Flemish* per *L.* Sterling how many *L.* Sterling are there in 1066 *L.* 13 *sh.* 4 *d. Flemish*,

1.777) 1066.666 (600 *L.* Sterling Answer
000000 *vide N.* 76, 78, 88, and 89,

10*th*, and 11*th*,

Qu. 9*th*, Suppose 1 *L.* 8 *sh.* 9 *d.* Sterling were to be Divided amongst 345 Poor People, what is each mans share?

345) 1.4575 (.00416
575
2300 *vide N.* 77.
2300 *in Infinitum.*

In this last Example with which I shall conclude this Section concerning Division the point Intimating that I am to have but two Figures in the Quotient and the *N.* 78, requiring four Decimals, I thereby understand that the first two of the *Decimals*, must be Cyphers as *per n.* 89.

These Examples do not only Illustrat the Rules but are in effect themselves as so many Rules and he that per-

perfectly understands them, will never be to seek in any thing of this nature.

SECTION VII.

Concerning the Rule of Three.

You have already learned how to Multiply and *Divide* in this Rule you must learne more perfectly when to do it. When 4 Numbers are so disposed that the greater of the first pair does contain the lesser or some aliquot part of the lesser, as oft as the Greater of the 2*d*. pair containes its Lesser; or the same aliquot part of its Lesser; than these 4 numbers are said to be in proportion to another Thus.

4; 8:: 6 12 .

3; 4:: 6 .8

91 The greater of both pairs are called Relative Numbers; & so are the lesser.

92 The Greater of the one pair and the Lesser of the other are called Coefficients.

You can never err in the *Disposition* of the 4 Numbers if you observe alwayes to make the Coefficients either both means or both extreams.

4; 8 :: 6; 12 3; 4 :: 6; 8

4; 6 :: 8; 12 3; 6 :: 4; 8

12; 6 :: 8; .4 8; 6 :: 4; 3

12; 8 :: 6; .4 8; 4 :: 6; 3

8; 12 :: 4; .6 4; 8 :: 3; 6

8; 4 :: 12; .6 4; 3 :: 8; 6

6; 4 :: 12; .8 6; 3 :: 8; 4

6; 12 :: .4; .8 6; 8 :: 3; 4

93 The

93 The nature and property of theſe proportionals is always ſuch, that the product of the means is equal to the product of the extreams.

Wherefore when only 3 of the Proportionals are given you may eaſily find the 4th.

94 Firſt you muſt diſpoſe the Numbers ſo as the Cofficient of that which is wanting may ſtand in the firſt place next the left hand for a Diviſor and the other two the one before, the other after, the Sign of proportion.

95 Secondly, you muſt Multiply the means and Divide the product by the Diviſor, and the Quotient yeilds the Anſwer.

96 Thirdly obſerve that both the Relatives muſt not only be of one ſort, but indeed of one Denomination by puting *ſh* and *d*, into Decimals of a *L*, as alſo haltes and quarters or other common Fractions into the Decimals of their proper Intigers to which they are annexed.

Upon this Theory depends the whole practiſe of the Rule of three called for its uſefulneſs and excellency the Golden Rule.

97 In every Queſtion belonging to this Rule you have three Numbers either expreſt or Implicitly given; to find a 4th.

98 Of the Three given Numbers thoſe are the Relatives that are of the ſame ſort, or Specirs, (one of which is alwayes the Diviſor) and the other of the 3 given Numbers, whoſe Relative is wanting, is caled the Singular Number, and the Number wanting we call the Anſwer, becauſe when it is found, it anſwers the Queſtion.

In Diſcerning the Diviſor (which is all the difficulty) obſerve this Rule.

99 When the answer ought to be greater than the Singular Number; then the least of the Relatives is the Divisor; but if the Answer ought to be less than the Singular Number, then the greater of the Relatives is the Divisor.

100 Having discovered the Divisor, set it next your left hand, and after it the other two (it matters not which) the one before, the other after the Signe of the Proportion; after all, first Multiply the means, and then Divide the product, so have you the Answer in the Quotient, which is always of the same Title or denomination, with the Singular Number.

Only observe that when the Divisor is an Unite, you have no use for Division; and if any one of the Coefficients be an Unite, you have no use for Multiplication.

I shall here Subjoyne some few Quotities for practise and Illustration of what hath been said, and with these conclude this Section.

Qu. 1*st*. If 3 ells cost 25 *L*. what will 345 $\frac{3}{4}$ ells cost?

ells	L.	
3	25	345·75
		25
		172875
		69150
		3) 8643·75
		2881.25 Answer 2881 *L*. 5*ſh*.

Qu. 2*d*. If 3453 $\frac{3}{4}$ ells cost 2881 *L*. 5*ſh*. what cost 3 ells?

ells

elle	elle	L.
345·75	3 ::	288125

3

345·75) 864375 (25 *L.*
173875
00000 This 2*d* Lemon proves the First

Qu. 3*d*. At 5 Merks *Scots per* Tron ston of Butter what will 87 *L.* Troise pay!

Lib.	*L*	*L.*
20;	3·333 .	87

23333
266666

20)290.000
14·5 Answer 14*lib*. 10*ss*.

Qu. 4*th* At 9*ss*. 4½*d*. per *lib*. what will 2997 *lib*. of Nutmegs come to?

lib.	*L,*	*lib*
1	46875	2997

2997

328125
421875 Here no Division
421875
93750

1404.84375 Answer 1404 *L*. 16*ss* 10½*d*

Qu.

Qu. 5*th*. If 2997*lib*. of Nutmegs coſt 1404*L*. 16*ſh*. 10½*d* what will 1*lib*. coſt

lib.	*lib*.		
2997	1	::	140.84375

2997) 1404.84375 (.46875 Anſwer 9*ſh*. 4½*d* this Leſſon *proves* the preceding.

20604
26223
22477
14985 Here no Muitiplication
0000

Qu. 6*th*. If ¾ ell coſt $\frac{4}{5}$ *L*. what will 25½ ells coſt.

ells	*L*.	ells
.75	.8	.25. 5 / 8

.75) 2040) 27,2 Anſwer 27 *L*. 4*ſh*.
540
150
000

You may ranverſe this as oft as you pleaſe, and add to theſe as many more Examplee concerning the prices of Goods.

SECTION VIII.

Concerning the Exchange of Money.

Qu. 1*ſt*. In 345 1 Merks *Scots* how many *L*. *Scots* are there?

2

m *L.* *m*
1.5 1 :: 345.5
1.5) 345.5 (230.333 *L.* Answer 230*L.* 6*sh.* 8*d*
45
050
50

Queſt. 2*d.* In 230 *L.* 6*sh.* 8*d* how many Merks are there

L. *m.*
1.5 1.5 :: 230.333
1.5
11151666
2303332
145.5000 Anſwer 345½ *Merks*

Qu. 3*d* At 4*ſh.* 10½ *d* per *French* Crown what Sterline money muſt one receive for 7563/4 *French* Crowns

Fr.Cr. *l. ſter*
1.5 .24375 :: 756.75
.24375
378375
529725
227025
302700 *Anſwer*
151350 184*L.*9*ſh.* ½*Far.*
184.4578125

After theſe Examples you may anſwer any Queſtions of this nature.

SECTION IX

THE next sort of Lessons shall concern the Equality between Rectangular Plangs of different Breadth & Length, and proportional Equality

Qu, 1*st*. How many Ells of 6 quarter broad Cloath will serve to hang a Room in stead of 50 Ells 3 1/2 quarter broad?

qr: br: qr, br:
6 ; 3,5 :: 50

50
6)1750(29,166

Answer 29 Ells 1/10 and 2/3 of 1/10

Qu. 2*d*. How many men will Suffice to do as much in 10 days as requires 30 men for 6 days.

dayes *dayes* *dayes*
10 ; 6 :: 30

30
180 *Answer* 18 *men*

Qu. 3*d*. how much Bullion 11*d*. Fine may one have for 35 Ounces 8 1*d*. Fine

2 11 ; 35

8.5
35
425
255
11) 297.5(27 1/22 Ounces An.
77
05

Qu

Qu. 4th. If the penny Loaf weight 8 Ounces when the Wheat is ten ſhiling the Boll how much ought the ſame to weight when the Wheat ſells at 15ſh. the Boll?

15ſ. 8 :: 10
10
15)80(5⅓ Ounces anſwer
5

Qu. 5th. A Merchant buyes from a Chapman 356 Speindles of Limning Yearn, which the Chapman obliges himſelf to deliver of the ten quarter Reel, but at the delivery the Yearn is found to be only of the 6 quarter Reel it is demanded how many Speindles hath the Merchant to pay for

qrs. long qrs. long Spendles
10 6 :: 35.6
6
213.6 Anſwer 2136 Speindles
1 10

Qu. 6th. How much 42 quarter broad Cloth will ſerve to lyne 15½ ells 6 quarter broad
2

br. br. ells
4.5 6 :: 15.5
6
4.5) 93.0 (20.666=202 ells
300 3
300 Infinite

SEC-

SECTION X.

Concerning Company Accounts.

Qu. 1st Suppose four Persons agree to Trafick for some time togither and A puts in 320 *L.* B. 156 *L.* *C*, 145 *L.* and *D*, 155 *L.* And at the closeing of their Accompts they find that their Profit amounts to 578 *L.*

In this you have as many Operations as their are persons Engaged. and the Totall Sum of all their Stocks is the *Divisor* and the profit and every mans particular Stock are the means or Coefficients.

A, *his Stock is* 320
B, *his Stock is* 156
C, *his Stock is* 145
D, *his Stock is* 155
776

L. Stock L. Stock Profit
776 ; 320 :: 578
820
11560 A's Profit
1734
776)184960(238.3505
2976
6480
2720
3920
94000
120

L. Stock L. Stock Profit
776 ; 156 :: 578
156
3468
2890 C's Profit
578
776)90168(116.195
1256
4808
1520
7440
4560
680

L. Stock	L. Stock	Profit
776 ;	145	:: 578
		145
		2890
		2312 B's Pro.
		578
776)828 10		(108.002
		6210
		002000
		448

L. Stock	L. Stock	Profit
776 ;	145	:: 578
		145
		2890
		2890 D's pr.
		578
776)895950		(115.45
		1199
		4230
		3500
		3960

But to compendize so laborious a work as this is (Especialy as it would be) if there were many persons concerned, as frequently it happens, in the laying on of a publick Stent, on the Heritors of a Parish or Shire, you need do no more but by one Operation cast up what it comes to *per* hundred, if the greatest Stock does not exceed hundreds, or *per* thousand, if it come to Thousands.

For Example suppose the Valuation of a Parish, or Shire ammounts To 97876 *L.* and that Lawfull Authority had laid one a Stent upon it of 3670 *L.* 7*sh.*

You need not make a great Multiplication and Division for finding every petty Heritours share of this Stent, only suppose the greatest Herritours Valued Rent exceed not Thousands, say.

L. Valuation	L. Stent	L. Valuation
97876 ;	3670.35	:: 1000
		1000
	367035.00	

97876) 3670350.00 (37.5 *L. Stent* per *Thousand*
734070
489380
000000

Having thus found that evry Thousand *L.* Valuation must pay 37 *L.*10*ſh*I constitute the following Table, and from it readily finde every mans proportion, (If there were a Thousand of them) meerly by Adition.

1	037.5
2	075.0
3	112.5
4	150.0
5	187.5
6	225.0
7	262.5
8	300.0
9	3375

In making this Table I ſet a Cypher before the rate for one Thouſand, and ſo doubles Triples and Quadruples &c. the reaſon of ſetting the Cypher, is that the Numbers in the Table may be equal in the Number of places

Now ſuppoſe that *A*, *D*, of *B*, his Valued rent were 1756 *L.* 16*ſh.* 8*d.*

I demand how much he ought to pay of the foreſaid Stent.

In order to Anſwer, you muſt firſt ſet down his Valued Rent in parts, ſetting before the Hundreds one Cypher, the Tens Two, the Unites Three, &c.

To make every ſignificant Figure a Number of as many Places, as are in a Thouſand Intigers or ought to follow it, and againſt theſe parts of the Valuation, ſet down firſt the Cyphers, prefixed to each ſignificant Figure, and after them the Numbers in the Table anſwering to the reſpective Signifying Figures, for the very ſame Numbers in the Table do not only ſerve as they are expreſt in the propor-

tion due for so many Thousands, but likeways for Hundreds, Tens, Unites, Decimal Primes, &c. According as you set One, Two, Three or Four &c. Cyphers before them, And for pence take the aliquot of one Decimal Prime or Five Seconds as you shall find it most convenient: All which is evident by what followes.

A, D, of B, his Valued Rent	*His Proportion of Stent*
L. 1000	0375
700	026.25
50	001.875
6	000.225
8	000.03
1	000.00125
3	
1756. 16. 8	65.88125

s *d*

Where observe that tho' the Fraction be less than 8*d*, yet being more than 7*d*, the Receiver must have 8*d*.

Thus I have shewed you by Addition alone to find every mans proportion of Stent, which the ordinary way would require a great Multiplication and tedious Division, which when there are many such would be exceeding troublesome.

SOmetimes Company Accounts are clogged with time. As suppose *A*, gives in 100*L*, 6 Moneths, and *B*, 200*L*, 3 Moneths, and *C*, 100*L*, 5 Months; In such a case you must Multiply every mans Stock by his time (their times being all in one common Denomination) and the several Products must be put in a place of each mans particu-

lar Stock, and the Sum of the ſame Products muſt ſtand for the whole Stock, and then proceed as before.

On Suppoſition that the Total of their gain is 510*L*, what is each mans ſhare?

A.	B	C
1200:510::600	1700:600::510	1700:510::500
600	600	500
1700)306000(180	1700)306000(180	1700)255000(150
13600	13600	8500
0000	0000	0000

SECTION X.

The next ſort of Leſſons ſhall be of Queſtions, in which there are Five Numbers all pertinent and ſuch Queſtions as theſe are beſt anſwered by two Operations. For Example,

At 6 *per* Cent *per Annum* ſimple Intereſt, how much will 756*L*. 17*ſh*. 6*d*. Yeild for 7½ Years?

In this Queſtion you have Five Numbers to wit 1 Year 7½ Years 100*L*. principal 756.875*L*. principal and 6*L*. Intereſt and you ſee that all of theſe Numbers are pertinent and that there are two pairs of Relatives, & but one Singular Number, wherefore you muſt take one pair of the Relatives Firſt, (& the Singular Number) for the firſt Operation, And the Number produced by it will be the Singular for the Second Operation, and ſo you may either ſay.

L. Prinll.	*Int.*	*L. Prinll.*	*or thus Int.*	*Years*	*Years,*
100 :	6 ::	756.875	1 :	6 ::	7½
		6			6
		45.41240			45.0 *L. Int.*

2d. Operation.

Year		L.	Inter
1 :	45·4125 :: 75	100 :	45 :: 756.875
	7·5		45
	2270625		3784375
	3178875		3027500
	340.59375		340.59375
	11*sh.* 10½*d*		11*sh.* 10½*d*

You see the last answers, both wayes, are the same.

Another Example of this sort shall be this; If 20 men are able to cast me a Ditch or Build me a wall 15 ell long in 8 days, how many will be able to Ditch or Build 45 ells in 4 days, Thus you may do it both wayes,

D.	*D.*	men	or Thus			
4 :	8 ::	20	15 :	20 ::	45	
	20				20	
4)160(			15)900(60 men Ans.			
40 men Answer.				00		

ells	*ells*	*men*	*D.*	*D*	
15 :	45 ::	40	4 :	8 ::	60
	40				60
15)1800(120 men Answer			4)480		
	30		120 men Answer		
	00				

Example of Discompt.

If 106*L.* due a Year hence Yeild but 100*L.* in pre-

sent Money, what must one have in ready money for 345*l.* payable at the end of $3\frac{1}{2}$ Years?

L prin, and profit *L prin,* *L prin and profit*

Year. *L.* *as* *Years*

1 : 6 :: 3.5

6

21.0

121 ; 100 :: 345

100

121) 34500 (285.12396

2030

0620

0150

0290

0480

0410

0810

940

This added to 100 yields the *Divisor* of the second Operation.

But for Intreſt or Diſcompt for days which is frequent with thoſe that deall in Borrowing and Lending, Payment making, or Receiving, the following method will render the work much more eaſie.

Dayes	Months	Dayes	L. Prin	L. P.	L. Int.
334	*January*	0	100	6 : 1	5 :.06 *per* An.
306	*February*	31	for $\frac{1}{2}$	a Year	.03
275	*March*	59	for $\frac{1}{4}$	a year	.015
245	*April*	90	for $\frac{3}{4}$	a year	.045
214	*May*	120	L.	P. L.	In. P.
184	*Inne*	151	100	5 : 1	1 ; .05 *per* An,
153	*July*	181			.025 p. $\frac{1}{2}$ year
122	*August*	212			.0125 p $\frac{1}{4}$
92	*Septer,*	243			.0376 p $\frac{3}{4}$
61	*October*	273			
31	*Nover,*	304			
0	*Decer,*	334			

From the end of Decmber to the last of evry Moneth,

From the First of January to the begining of every Moneth,

Thoſe

These Proportions do very well for halfs and Quarters, as to ſimple Intereſt, but if the time be more or leſs than Halfs or Quarters, the moſt accurate way is to compute the Value of one L. *per diems*, Thus.

Days	L	*Day*		L
365 :	06 : :	1	Anſwer	.0001643835
365 :	05 : :	1	Anſwer	.0001369863

From which Numbers the following Tables are conſtructed

Days. Int. of 1 L *at* 6 *p.C.*	*D. Int. of* 1 L *at* 5 *p.C. p.d.*	
1 .0001643835	1 .0001369863	These Tables
2 .0003287670	2 .0002739726	readily afford
3 .0004931505	3 .0004109589	not only the
4 .0006575340	4 .0005479452	Intereſt of 1 L
5 .0008219175	5 .0006849315	for any Num-
6 .0009863010	6 .0008219178	ber of days not
7 .0011506845	7 .0009589041	exceeding Uni-
8 .0013150680	8 .0010958904	ites, but alſo for
9 .0014794515	9 .0012328767	any number o

Tens, Hunders, for Thouſands, &c. merely by removing the Decimal Point 1, 2, 3, or more ſteps towards the Right Hand

Thus, Were it demanded what the Intereſt of 1 L would come to from the 3d of *February*, to the 17th of *October*, you muſt do it thus;

First, from the beginning of *January* to the beginning of *October* there are Days } 273 } 290
To which adding the 17 Days of *October* } 17 }
The Sum is 290
From which Subſtracting 31+3=34 the remainder is 256

Days,

Days 200 .03287670 .027397262
50 .00821917 .00684931 55
6 .00098630 .00082161 786
So that 1 L in 256 at 6 p. C. is .042082176 at 5 p. c, .035068493 56

These Numbers Multiplyed by any other Number, will yield the Intereſt of the ſame Number for the ſame ſpace of time

But if it were demanded what the Diſcompt of any Number will at the given Rates comes to (or which is the ſame) what any Sum payable 256 Days hence, is worth in preſent Money? In this caſe you muſt Add 1 L to the Intereſt of 1 L for the time propoſed, and Divide the Number aſſigned by the Sum, ſo have you the preſent Worth demanded

Thus, were it demanded what 345 L payable Two Hundred and Fifty Six Days hence, will be worth in preſent Money; becauſe the Intereſt of 1 L for the time prefixed is .042, and this added to One L is 1.042, therefore the Proportion will be

1.042 : 1 :: 345

1.042) 345.000 (331.094

3240

1140

.09800

4220

.052

I have here ſatisfyed my ſelf with the firſt Three Figures of the Amount or Intereſt of 1 L for 256 Days, and yet the anſwer is but 5 or 6 d more than it would have been had I uſed them all.

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APPENDIX.

SECTION XII.
Concerning COMPOUND INTEREST.

I Shall now proceed, in the next Place, to give you an account of the manner how *Compound Interest*, or *Interest upon Interest* ought to be computed, and in order to this, Obſerve that,

In *Logarithms* the Signs of *Poſitive* and *Defective* Numbers are carefully to be regarded.

The *Logarithms* of all Integers are *Poſitive* Numbers, whether they have Fractions annexed or not, & their Sign is (+) prefixed to the Characteriſtick, or if no Sign be prefixt to it, you muſt allow the Poſitive Sign to be underſtood

The Logarithms of all Numbers below Integers muſt have a Negative Sign, to wit (-) prefixed to them.

Addition of Logarithms is equivalent to the Multiplication of their Natural Numbers

Subſtraction of Logarithms is equivalent to the Diviſion of their Natural Numbers

Multiplication of Logarithms by 2, 3, 4, *&c.* is equivalent to the Involution, or raiſing of its Natural Number to the 2d, 3d, or 4th Power, according to the Figures that Multiplyes the Logarithms.

Diviſion of a Logarithm by 2, 3 4, 5, 6, *&c* is equivalent to the Extraction of the Root of its Natural Number, to the 2d, 3d, 4th fifth or ſixth Power, according to the *Diviſor* of the Logarithm

The Characteriſtick of a Logarithm indicates the Power

of the Natural Number, ſo, 0, Indicates Integer Unites, and 1, ſignifies that the firſt figure of your Number is Tens: 2, Hundreds: 3, Thouſands, and ſo *in infinitum*.

On the other hand, -1, ſignifies that the firſt figure of your Natural Number is Decimal Primes, -2, Seconds, -3, Thirds.

In Addition, the Unites carried to the Column of Characteriſticks are always *Poſitive*, and if the Sum of the Poſitive Characteriſticks be juſt equal to the Sum of the *Defective*, then the Characteriſtick of the Total is 0,

But if the Poſitive and Defective be unequal, you muſt prefix to the Difference, the Sign of the greater Sum, for the Characteriſtick of the Total.

In Subſtraction the Unite carried (on account of Borrowing) to the Column of Characteriſticks, is allways *Defective*

Alſo you muſt in Subſtraction conſtantly reckon the Characteriſtick of the Diſcharge, or Diviſor, to be quite contrary to what it is; That is to ſay, Poſitive when it is Defective, and Defective when it is Poſitive.

And then in ſtead of Subſtracting theſe Characteriſticks you muſt do with them as in Addition

After the ſame manner the Unites carried in Multiplication to the Product of the Characteriſtick are always Poſitive, and that whether the Product of the Characteriſtick be Poſitive or Defective.

But in Diviſion if the Defective Characteriſtick be leſs than the Diviſor, or exceed ſome Multiply of it, then you muſt add as many to the Characteriſtick as will make it contain the Diviſor Once, Twice, Thrice, *&c.* and the Unites ſo added muſt be prefixed to the next ſubſequent Figure of the Logarithm, as if there had ſo many remained, & ſo proceed in Division as in Integers.

Mul-

(*Multiplication* (in Natural (Numbers.	(*Addition* in) (*Logaritbms.*)	(*Diviſion* in Na-) (tural Numbers)	(*Subſtraction*) (in *Loga-*) (*rithms.*)
Multipd 175	1)Log 2,243038	Dnd 6125	1)Log 3:787106
Multyr 35	1,544068	Df. 175	log 2:243038
Product 6125	3,787106	Quotient 35	1:544068
Multpd 17.5	2)log 1,243038	Dnd 612.5	2)Log 2:787106
Multpy: 35	Log 1,544068	Df 17.5	1:243038
pdct 612.5	2,787106	Quotient 35	1:544068
Multipd 1.75	3) 0,243038	Dnd 61.25	3)log 1:787106
Multpy 35	1,544068	Df 1.75	0:243038
pduct 61.25	1,787106	Quotient 35	1:544068
Multpd .175	4)Log 1,243038	Dnd 6.125	4)Log 0:787106
Multpy 35	1,544068	Df .175 log	1:243038
pduct 6,125	0,787106	Quotient 35	+ 1:544068
Multipd 175	5)Log 2,243038	Dnd 612.5	5)log 1:787106
Mulpy 3.5	0.544068	Df 175 log	2:243038
pduct 612.5	2,787106	Quot 3.5	0:544068
Multipd 175	6)Log 2:243038	Dnd 6,125	6)log 1:787106
Mulpy .35	Log 1:544068	Df 175 log	2,243038
pduc 61.25	1:787106	Quotent 35	-1:544068
Multpd .175	7)log -1:243038	Dnd .6125	7)log -1:787106
Multpy 3.5	Log 0:544068	Df .175 log	-1:243038
pduct .6125	-1:787106	Quotent 3.5	0:544068
Multpd .175	8)Log -1:243038	Dnd .06125	8)log -1:787106
Multipy .35	Log -1:544068	Df .175 log	-1:243038
pduc .06125	-2:787106	Quotent .35	-1:544068
Multpd .175	9)Log -1:243038	Dnd .612	9)log -1:787106
3.5	0:544068	Df .175 log	-1:243038
.6125	-1:787106	Quotient 3.5	0:544068
Multipd 1.75	10)log 0:243038	Dnd 6:125	10)log 0.787106
Multpy 3.5	0:544068	Df 1 75 log	0:243038
pduct 6.125	0:787106	Quotien 3.5	0,544068
Multpd .175	11)log -1:243038	Dnd .6125	11)log 1,787106
Multpy 3.5	0:544068	Df .175	1243038
pduct .6125	-1,787106	Quotient 3.5	0;544068

In all these Instances you see that the Logarithms are the same; for the same figures, whether they be *Integers*, *Decimals*, or *Mixt Numbers*, and the Affections of the Characteristicks does sufficiently indicate to which of these Classes the Natural Number does belong.

One Example of Division shall be this. Let it be desired to extract the Cube-Root of the following number,

.015625	the Logarithm of which is	-2,193820
	the $\frac{1}{3}$ of which is	-1,397940
	the natural number of which is	.25

And if you desire to know the Cube of .25 the natural number foresaid, Multiply its Log: to wit -1,397940 by Three;

3

and the Product is -2,193820

The natural number of which is .015625 *ut supra*; All which Examples do sufficiently demonstrate the Certainty of the Rules assigned in the beginning of this Section.

Now because the computation of *Compound Interest* encreaseing is very tedious the Arithmetical way; and much more so, decreaseing because of the manifold Divisions, or Extractions of Roots requisite in the Operation.

I have therefore thought fit to let you see the Excellency and Usefulness of the Log. to this purpose

Suppose then that it were demanded what One Pound for born for Eight Years will be worth at the Term of Payment, with Interest upon Interest, at 6 *per Cent per annum*.

In this Lesson yon have as many Operations the Arithmetical way, as there are years propounded; wherein you must allways make the answer of the immediatly preceed-

ing

ing, one of the Three Numbers in every subsequent Operation; Thus,

L prin. & pr.

100; 106 :: 1; 1.06 for the first Year
and then 1; 1.06 :: 1.06 Now if we make 1.06 = *b* then
First Year 1.06 the second Analogie wil be
636 1; *b* :: *b*; *bb* second Year
bbb third Year
second Year 1.1236 *bbbb* fourth Year
67416 *bbbbb* fifth Year
11236 *bbbbbb* sixth Year
third Year 1.191016 *bbbbbbb* seventh Year
1.06 *bbbbbbbb* eighth Year
7146096
1191016
1262476 96

urth Year 1262476 96
1.06
7574861 76
1262476 96
fifth year 1.338225577 6
1.06
80293534659
13382255776
sixth 1.418519112256
1.06
85111146735 36
14185191122 56
1.503630258991 36

Wherefore since the last Product is nothing else but the eighth Power of (*b*) you may come to your purpose much sooner, were your business ten times greater, if you multiply the Log of (*b*) by the Index of its Power, (that is) the number of Years proposed, and the Product yields the Log, of the Number desired, thus,

1,06 = *b* Log 0,025306
multiplied by 8 8
yields Log of 1.593, 0,202448

If to this you add the Log of any other number, you in-

seventh 1.503630258991 36 instantly have the Amount
1.06 of that number for ſo many
9021781553948 16 years.
1503630258991 36
8th. 1.593848074530841 6
1L. 11. 8h 10 d. and ſome little more

FIRST EXAMPLE,

Suppoſe it were demanded, What is the Amount of 3725L or 372L 10ſh, or 37L 5ſh, or 3L 14ſh 6d in the ſpace of 8 years compound Intereſt at 6 *per Cent. per annum*?

In which Queſtion making $c=3725$, the analogy is this

$$1; b8 :: c; cb8$$

$b8$ Log. *ut ſupra* is	0.202448
c Log. is	3.571126
$cb8$ is	3.773574 = 5937.1L

The number found according as you vary the Characteriſtick of (*c*) wil yield you for the ſecond Anſwer, for 372L 10ſh .593.71
And for 37L 5ſh --59.371
And for 3L 14ſh 6d - - ---5.9371

SECOND EXAMPLE,

Were it demanded what one L due 8 years hence would be worth in preſent Money, diſcompting Compound Intereſt for the advance? In finding the Diminitive Amount of one L, the Analogy is this $b8$ 1 :: 1; $\frac{1}{b8}$

Wherefore 1; Log is 0.000000
$b8$ Log is 0.202448

The difference Log 1.797552 = .6275 *fere* 12ſh 6d od

$\frac{1}{b8}$

Now

2 Now if it were demanded what the Diminitive Amount of any other number, suppose 325L 15sh would be discompting Compound Interest for Eight years advance before the Term, then making a=325.75, the analogie will be this, 1; $\frac{1}{b8}$ :: d; $\frac{d}{b8}$ or which is the same thing $d \times \frac{1}{b8}$, $\frac{1}{b8}$

Now $\frac{1}{b8}$ Log is	-1,797552	d Log	2,512884
And d Log is	2,512884	or $b8$ Log	0,202448
Sum=$d \times \frac{1}{b8}$ is	2,310436	diff. $\frac{d}{b8}$ Log	2,310436

Both which Logarithmes being the same, you'll find the Absolute number to which they refer you to be 204Lib. 8sh, 5d, *fere*

Let us suppose, in the next place, that it were demanded what would be the Monthly, Quarterly, or half years Intereft of 1L, provided the Compound Intereft *per mensem* may not exceed 1.06L of Amount for Principal and Profit *per annum*.

In this case let a=to the first months Intereft, added to the principal One L, and putting b=1.06=$a12$) and aa= to the 2d; $a3$=to the Third months Intereft, and so at length $a12$ will be equal to 1.06, Thus $a12 = b$

Hence it will follow that

$a = \sqrt[12]{b}$ for one Month
$aa = \sqrt[6]{b}$ for two Months
$a3 = \sqrt[4]{b}$ for three Months
$a4 = \sqrt[3]{b}$ for four Months
$a5 = \sqrt[2.4]{b}$ for five Months
$a6 = \sqrt[2]{b}$ for six Months
$a7 = \sqrt[12]{b^7}$ for seven Months

All which Extractions are very difficult the Arithmetical way (and perhaps some of them are such as never Man did e-

ver yet attempt to extract [illegible] for eight Months and yet they are moſt eaſi[illegible] for nine Months by the Logarithms ; n[illegible] for Ten Months need you any, but the [illegible] for eleven Months Logarithm of the firſt E[illegible] = 6 = 1,06 tion, in Finding which you have only to Divide the Logarithm of 1,06 by (12) and the Quotient is the Logarithm of the Amount for the Firſt Month of One Pound, and thus multiplyed by any other number of Months, yields the Amount of One L for the time propoſed ; To which add the Logarithm of any other number ; So have you the Logarithm of that number for that time.

Example, What is the Amount of 27 L, 15 ſh, 6d, for 15 Months Compound Intereſt, at 6 *per Cent per Annum*, paying Monthly Intereſt.

a = 1,06 Log. 0,025306

12) 1,06 Log. is $\frac{1}{12}$ of the 0,002108

firſt Log. which multiplyed by

0,021688

Yields Log. of the Amount of 1 L for 15 Months 0,021688

Log. is 1,607193

The Amount 1,607285

Example, What comes 1 L. *per annum* to, forborn five years, at 6 *per cent.* compound Intereſt ?

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